

WHAT IS CLAIMED IS:

1. A via hole defining process performed in one etching chamber, comprising:
 - 1 providing a substrate having a dielectric layer and a patterned mask layer formed sequentially thereon;
 - 2 anisotropically etching the dielectric layer in an etching chamber to form a via hole by using the patterned mask layer as a mask;
 - 3 removing a portion of the patterned mask layer around the via hole in the etching chamber; and
 - 4 removing a portion of the dielectric layer around an upper portion of the via hole with the remaining patterned mask layer as a mask.
2. The via hole defining process of claim 1, wherein the step of removing a portion of the patterned mask layer comprising performing an oxygen plasma treatment in the etching chamber.
3. The via hole defining process of claim 2, wherein a bottom power used in the oxygen plasma treatment ranges from about 0.1W to about 50W.
4. The via hole defining process of claim 2, wherein a top power used in the oxygen plasma treatment ranges from about 500W to 2000W
5. The via hole defining process of claim 1, wherein a reaction gas used in the step of anisotropically etching the dielectric layer comprises fluorohydrocarbons $(C_xH_yF_z)$.
6. The via hole defining process of claim 5, wherein the reaction gas further comprises argon (Ar).
7. The via hole defining process of claim 5, wherein the reaction gas further comprises carbon monoxide (CO).

8. The via hole defining process of claim 5, wherein the reaction gas further comprises oxygen (O₂).

9. The via hole defining process of claim 1, wherein a material of the patterned mask layer comprises a photoresist material.

5 10. The via hole defining process of claim 1, wherein a material of the patterned mask layer comprises a spin-on polymer.

11. The via hole defining process of claim 1, wherein a material of the patterned mask layer comprises an organic low dielectric constant (low-K) material.

12. The via hole defining process of claim 1, wherein a material of the dielectric 10 layer comprises an inorganic oxide material.

13. A via hole defining process, comprising:
providing a substrate having a dielectric layer thereon;
forming a patterned mask layer on the dielectric layer, wherein the patterned mask layer has at least one opening formed therein;

15 performing a first anisotropic etching process to form a via hole in the dielectric layer by using the patterned mask layer as a mask;
removing a portion of the patterned mask layer around the via hole with an oxygen plasma treatment; and

20 performing a second anisotropic etching process to remove a portion of the dielectric layer around an upper portion of the via hole by using the remaining patterned mask layer as a mask, wherein the first anisotropic etching process, the second anisotropic etching process, and the oxygen plasma treatment are performed in one single etching chamber.

14. The via hole defining process of claim 13, wherein a bottom power used in

the oxygen plasma treatment ranges from about 0.1W to about 50W.

15. The via hole defining process of claim 13, wherein a top power used in the oxygen plasma treatment ranges from about 500W to 2000W

16. The via hole defining process of claim 13, wherein a reaction gas used in the

5 first or the second anisotropic etching process comprises fluorohydrocarbons ($C_xH_yF_z$).

17. The via hole defining process of claim 16, wherein the reaction gas further comprises argon (Ar).

18. The via hole defining process of claim 16, wherein the reaction gas further comprises carbon monoxide (CO).

10 19. The via hole defining process of claim 16, wherein the reaction gas further comprises oxygen (O_2).

20. The via hole defining process of claim 13, wherein a material of the patterned mask layer comprises a photoresist material.

15 21. The via hole defining process of claim 13, wherein a material of the patterned mask layer comprises a spin-on polymer (SOP).

22. The via hole defining process of claim 13, wherein a material of the patterned mask layer comprises an organic low dielectric constant (low-K) material.

23. The via hole defining process of claim 13, wherein a material of the dielectric layer comprises an inorganic oxide material.